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Agricultural Memorandum No 706

End of winter drainage, 1941-1970

L P Smith

It is difficult to define the date when drains cease to run in the spring owing to the intermittent nature of the event. It is also very difficult from monthly data to estimate a date of departure from soil moisture capacity, and much depends on the relative accuracy of the P.T. and rainfall data and the nature of the ground cover.

In an attempt to resolve the difficulties without introducing too much inaccuracy, the following procedure was adopted.

If in March the P.T. exceeded the rainfall, and any deficit was made good in April so that further drainage was likely, the end of winter drainage was considered to be in May (or later); the March cessation being regarded as only temporary.

If in April the P.T. exceeded the rainfall, then the end of winter drainage was considered to occur during this month, and any possible excess rain in May (or later) was regarded as a temporary "summer" drainage.

The number of days the drains ceased to run before the end of a month in which P.T. exceeded rainfall, was estimated by multiplying the ratio of S.M.D. at the end to the monthly P.T. by the days in the month. This gave a termination date which was consistent if not accurate. The method will tend to give late values especially when there is only a small deficiency of rainfall, but this is partly compensated by the time lag between departure from capacity and cessation of drainage.

The 30 year, 1941-1970, data for the Tech. Bull. No 24 stations were analysed in terms of earlier quartile, median and later quartile dates for each station.

For smoothing and interpolation purposes, regression formulae were then sought using a selection of variables. The best results, in terms of days after the end of February, were as follows:-

	Earlier Quartile Date	Median Date	Later Quartile Date
North West	$0.039R_A+9.0$	$0.042R_A+26.6$	$0.082R_A+11.2$
North East	$0.51R_{MA}-30P_{MA}+74.5$	$0.76R_{MA}-21.6P_{MA}+48.8$	$0.56R_{MAM}-7P_{MAM}+35.8$
Midland	$0.35R_{MAM}-16.9P_{MA}+29.5$	$0.087R_A-24.9P_{MA}+70.6$	$0.11R_A-30.7P_{MA}+97$
East	$0.1R_A-11P_{MA}-5.8$	$0.1R_A-29.4P_{MA}+74$	$0.05R_A-23.6P_{MA}+105$
Southeast	$0.75R_M-12.9$	$0.61R_{MA}-16.6P_{MA}+45.7$	$0.6R_{MA}-14.4P_{MA}+63.4$
Southwest	$0.46R_{MA}-55.5P_{MA}+171$	$0.25R_{MAM}-15P_{MAM}+109$	$0.16R_{MAM}-11P_{MAM}+124$
Wales	$0.34R_{MA}-2.1P_{MA}+9$	$0.36R_{MAM}-17.1P_{MAM}+103$	$0.54R_{MAM}-2.9P_{MAM}+3$

where R_A, R_M, R_{MA}, R_{MAM} is the average rainfall in millimetres in year, March, March + April, and March + April + May respectively, and

P_{MA}, P_{MAM} is the potential transpiration in inches in March + April and March + April + May respectively.

Of the 21 multiple correlations

8 exceeded 0.90
7 lay between 0.8 and 0.9
4 lay between 0.7 and 0.8
and 2 between 0.6 and 0.7 (in Eastern region)

It is emphasized that only a small increase in the rainfall of future Aprils will completely change the situation.

Any comments or suggestions on this paper should be referred to the author.

Meteorological Office
Bracknell

February 1975

APPENDIX

NORTH		Average Annual Rainfall	Earlier Quartile	Median	Later Quartile
Ambleside	Westmoreland	1902	May 17	June 11	Aug 5
Bolton	Lancashire	1419	May 17	May 28	July 24
Morecambe	Lancashire	982	April 22	May 18	May 29
Ilkley	West Riding	917	April 15	May 11	May 28
Blackpool	Lancashire	862	April 11	April 22	May 12
Newton Rigg	Cumberland	930	April 7	May 10	May 24
Bellingham	Northumberland	967	April 10	May 17	June 16
Manchester	Lancashire	819	April 7	April 29	May 22
Carlisle	Cumberland	794	April 8	April 24	May 15
Ampleforth	North Riding	738	April 5	April 23	May 23
Cockle Park	Northumberland	729	March 21	April 9	May 9
Houghall	Durham	682	March 20	April 12	April 29
Wakefield	West Riding	633	March 26	April 17	May 9
Askham Bryan	West Riding	623	March 26	April 15	May 6
Driffield	East Riding	664	March 23	April 19	May 13
Tynemouth	Durham	638	March 18	April 13	May 9
Hull	East Riding	645	March 23	April 16	May 9
Berwick	Northumberland	590	March 18	March 29	April 24
Finningley	Nottingham	578	March 15	April 5	April 26
MIDLANDS					
Hanley	Stafford	797	April 8	April 29	May 25
Delamere	Cheshire	832	April 8	May 8	May 26
Birmingham	Warwick	774	April 13	April 29	May 28
Gt Missenden	Buckingham	763	March 24	April 23	May 18
Walsall	Stafford	740	March 26	April 20	May 22
Chipping Norton	Oxford	725	March 24	April 13	May 11
Belper	Derby	724	March 30	April 29	May 22
Ross-on-Wye	Hereford	708	March 26	April 16	May 12
Mansfield	Nottingham	695	March 30	April 18	May 9
Cheltenham	Gloucester	665	March 23	April 15	May 14
Towcester	Northampton	685	March 23	April 10	May 8
Leicester		675	March 26	April 20	May 15
Oxford		659	March 16	April 16	April 27
Shrewsbury	Shropshire	627	April 7	April 20	May 19
Worcester		651	March 24	April 12	April 29
Leamington Spa	Warwick	599	March 23	April 17	May 8
Kettering	Northampton	574	March 18	April 6	April 24
Newport Pagnell	Buckingham	607	March 21	April 10	April 23
Ketton	Rutland	640	March 21	April 12	May 13
Cranwell	Lincoln	590	March 16	April 5	April 27
Sutton Bonington	Nottingham	611	March 28	April 18	May 8

		Average Annual Rainfall	Earlier Quartile	Median	Later Quartile
EAST					
Swaffham	Norfolk	637	March 19	April 8	April 25
Sprowston	Norfolk	601	March 17	March 29	April 25
Spalding	Lincoln	568	March 16	April 6	April 26
Lowestoft	Suffolk	602	March 14	April 9	April 25
Cleethorpes	Lincoln	601	March 16	April 8	April 26
Saffron Walden	Essex	577	March 14	March 26	April 19
March	Cambridge	578	March 12	March 30	April 21
Sandy	Bedford	578	March 14	April 12	April 26
Kings Lynn	Norfolk	623	March 19	March 26	April 19
Cambridge		556	March 12	March 30	April 22
Hatfield Peverel	Essex	563	March 14	March 26	April 28
Mildenhall	Suffolk	536	March 7	April 2	April 23
St Ives	Huntingdon	573	March 10	March 24	April 17
Felixstowe	Suffolk	561	March 12	March 26	April 14
SOUTH-EAST					
Bodiam	Sussex	815	March 26	April 23	May 16
Wye	Kent	739	March 22	April 21	May 11
Chichester	Sussex	787	March 24	April 16	May 11
Wantage	Berkshire	706	March 26	April 20	May 11
Rothamsted	Hertford	697	March 19	April 6	April 29
Portsmouth	Hampshire	702	March 24	April 16	April 27
Wealdstone	Middlesex	650	March 20	April 3	April 29
Croydon	Surrey	670	March 19	April 5	May 11
S Farnborough	Hampshire	669	March 14	April 7	May 13
E Malling	Kent	671	March 24	April 17	May 16
Reading	Berkshire	640	March 17	April 4	April 30
Kew	Surrey	599	March 14	April 2	April 27
Swanley	Kent	597	March 20	April 7	April 27
Margate	Kent	576	March 8	March 26	April 19

SOUTH-WEST		Average Annual Rainfall	Earlier Quartile	Median	Later Quartile
St Austell	Cornwall	1218	April 20	May 10	May 29
Plymouth	Devon	971	April 13	April 26	May 21
Hartland Point	Devon	866	March 26	April 23	May 25
Newquay	Cornwall	881	March 29	April 20	May 15
Blandford	Dorset	876	April 2	April 22	May 18
Marlborough	Wiltshire	822	April 6	April 26	May 20
Lizard	Cornwall	880	April 11	April 24	May 20
Bristol	Gloucester	809	April 15	April 26	May 13
Exeter	Devon	868	April 2	April 18	May 12
Leckford	Hampshire	803	March 30	April 22	May 19
Bournemouth	Hampshire	802	March 24	April 20	May 13
Cannington	Somerset	737	March 30	April 26	May 22
Martock	Somerset	724	March 17	April 12	May 10
Boscombe Down	Wiltshire	724	March 21	April 14	May 18
WALES					
Carmarthen		1348	April 27	May 26	July 22
Brecon		1090	April 14	May 16	May 30
Aberdovey	Merioneth	1245	April 23	May 17	June 18
Cardiff	Glamorgan	1085	April 26	May 20	June 9
New Radnor		1056	April 20	May 19	June 21
Pembroke		1102	April 17	April 27	May 22
Cardigan		1023	April 19	May 16	May 28
Derwen	Merioneth	1027	April 20	May 17	June 11
Abergavenny	Monmouth	1030	April 13	May 20	June 6
Amlwch	Anglesey	1016	April 21	April 27	May 16
Wrexham	Denbigh	870	April 4	April 27	May 30
Welshpool	Montgomery	854	April 4	April 22	May 23
Denbigh		771	April 6	April 17	May 11
Hanmer	Flint	751	March 29	April 21	May 15
Llandudno	Caernarvon	731	April 2	April 23	May 10